FOREST PRODUCTS
Project Fact Sheet

CHARACTERIZATION AND CONDITIONING OF TARS PRODUCED DURING BLACK LIQUOR GASIFICATION

BENEFITS

- Fundamental knowledge about tar formation and destruction in black liquor gasification processes
- Increased ability to optimize operating variables and process conditions for black liquor and biomass gasification
- Reduced risks in the chemical recovery cycle and improved efficiency and productivity in the pulp and paper industry
- At low temperatures, no smelt production during recovery, improving safety of process

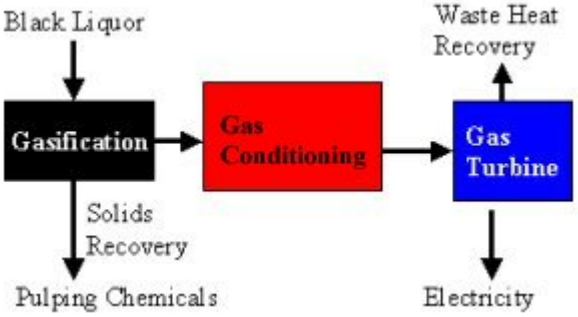
APPLICATIONS

The tar destruction methods, sulfur and alkali removal processes, and information on optimal processing conditions will be useful to all gasification process developers. Commercial-scale testing of these processes will accelerate the development of commercially-available combined-cycle black liquor and biomass gasification systems.

Study Will Clarify Formation and Control of Tars During Black Liquor Gasification

Black liquor gasification is a promising technology for energy production and chemical recovery in the pulp and paper industry. Gas turbines fueled by the product gas from the gasification of black liquor or biomass residues generated on-site have the potential to produce electricity much more efficiently than conventional recovery boilers. Gasification units may also have lower capital costs and provide greater process flexibility than new recovery boilers because they can be added as modules to incrementally increase mill capacity. In the near term, gasification units can be used in tandem with existing recovery boilers to increase mill capacity, improve power-to-heat ratios, enhance pulping processes, and reduce pulping costs.

It is safer to carry out gasification at lower temperatures than at higher temperatures because no smelt forms and all of the sodium used in pulping can be recovered in solid form. However, more organic tars are produced at low temperatures and they must be removed before the black liquor gasification product gas can be burned in a gas turbine. The catalytic removal of tars can be hampered by the presence of sulfur, alkali metals and particulates, which are also produced during black liquor gasification. This study will focus on gaining a better understanding of the tar materials formed during black liquor gasification and developing effective methods for catalytically destroying these materials. Methods to minimize sulfur, sodium and particulates in the product gases will also be investigated.



Simplified process flow diagram of black liquor gasification highlighting the importance of gas conditioning for protecting downstream electricity generating equipment

PROJECT DESCRIPTION

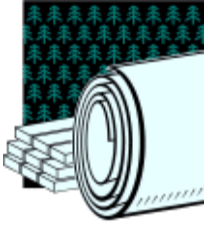
Goal: Study the formation and catalytic destruction of organic tars during black liquor gasification at the bench- and process development unit (PDU) scales.

Tar-destruction catalysts work best when the sulfur and alkali metals produced during black liquor gasification are at low levels, and particulates have been filtered out. Methods will be sought for the catalytic destruction of tars, and for removal of sulfur and minimizing sodium in the product gases. The molecular beam, mass spectrometry (MBMS) facility at the National Renewable Energy Laboratory (NREL) will be used to identify tars produced during gasification and to study evolution and fate of sulfur and alkali metals. A final report will be prepared that documents the tar destruction process as well as optimum methods for hot particulate filtering, sulfur scrubbing, and alkali removal at the PDU scale.

PROGRESS & MILESTONES

- Bench-scale MBMS experiments at NREL have characterized the product gases from hardwood and softwood black liquor gasification; the Institute of Paper Science and Technology, in collaboration with the Georgia Institute of Technology, has characterized the sulfur, sodium, and tars produced during gasification and that remaining in the gasification residues. The results of these studies will be produced in a milestone report.
- NREL and IPST/GIT will investigate methods for particulate, sulfur, and alkali mitigation, and screen various catalysts for tar destruction. The results of these studies will be produced in a milestone report including recommendations of optimum catalysts for tar destruction and optimum methods for removing the other impurities.
- Optimum conditions for black liquor gasification at the process-development-unit (PDU) scale will be investigated and the results of these studies will be produced in a milestone report.
- Recommendations for the best potential process strategies for commercial scale testing will be made at the completion of this project in a final report.

One of NREL's Molecular Beam Sampling Mass Spectrometer Instruments. This transportable unit is available for real-time, on-line process monitoring at laboratory, pilot-scale and commercial-scale facilities.



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